

Landowner \_\_\_\_\_

**WHAT IS TOXIC SALT REDUCTION?**

Toxic Salt Reduction is the reduction or redistribution of harmful concentrations of salt and/or sodium in a soil using the leaching process.

**PURPOSE**

The purpose of Toxic Salt Reduction is to improve soil conditions to permit desirable plant growth.

**HOW IT HELPS THE LAND**

This practice can help reclaim land where salt concentrations have developed in the plant root zone. This includes areas known as oil-waste land. Salt accumulations in the soil are not the result of saline seeps.

**WHERE THE PRACTICE APPLIES**

This practice applies to land where the accumulation of salt at or near the surface limits the growth of desirable plants.

**WHERE TO GET HELP**

For assistance with this practice, contact your local Natural Resources Conservation Service or your local Conservation District office.

**APPLYING THE PRACTICE****Saline Soils**

Naturally developed saline soils usually represent only small areas of a field but can extend to larger areas. Often, these areas are found in bottomlands which have poor internal drainage and a shallow water table. Other small areas occur on slopes where erosion has exposed saline subsoil. Soil surveys often indicate the location and extent of saline soils.

Capillary rise from the shallow water table carries soluble salts occurring in the soil or bedrock to the surface. The water evaporates on the soil surface and leaves behind salts.

These soils are also frequently wet during cultivation and can become compacted in and around the wet areas. A very thin white crust will develop on the soil surface as the soil dries.

Crop production is reduced in these areas due to the salt accumulation. Seedling plants are very sensitive to water stress which leads to stand reduction.

Saline soils generally have a very good soil physical condition throughout the tillage depth. When these soils are not too wet, they are friable, mellow, and easily tilled.

Soil which has been saline for several years will be very fertile and high in N, P, and K. These nutrients build up in salty areas because of limited crop removal over time. Soil pH remains relatively unchanged. Electrical Conductivity (EC) of the soil extract is greater than 4 mmho/cm at 25°C, soil pH is below 9, Sodium Adsorption Ratio (SAR) is less than 13, and Exchangeable Sodium Percentage (ESP) is less than 15. The EC is generally consistent throughout the soil profile.

#### **Alkali (Sodic) Soils**

Alkali soils contain excessive amounts of sodium. This can result from excess sodium in the subsoil by mineral weathering or sodium rich water applied to the surface.

Sodium forces the soil particles to separate and causes the soil to disperse. Alkali soils are not friable and mellow like saline soils. Instead alkali soils are greasy when wet, especially if it is fine textured and often very hard when dry. They are often characteristically too wet or too dry for tillage. Therefore, poor seed germination and stand establishment are common because good seedbed preparation is difficult.

The pores in the soil which allow water to infiltrate become plugged with the dispersed clay and organic material. As a result, the subsoil is very dry even though water is ponding on the surface. Plants in the area often suffer water stress and may eventually die from lack of water and oxygen.

Alkali soils will have an ESP greater than 15%, a SAR greater than 13, and generally a pH greater than 9.

#### **Induced Saline and Alkali Soils**

Saline and/or sodic soils can be induced with liquid wastes from saltwater brine released from oil wells.

Saltwater brine is concentrated sodium chloride along with other salts and possibly toxic elements. It can result from seepage of evaporation ponds, leakage from wells and pipelines or from unloading tank trucks at the site.

These sites have soils that are dispersed, have a white crust and are mostly bare of vegetation. Soil erosion is generally active at the site which has exposed the subsoil.

#### **IDENTIFY THE PROBLEM**

Saline and alkali soils have similar characteristics and can be confused with each other. Verifying the soil condition present is best done with soil testing.

Problem areas shall be evaluated in one of the following ways:

1. A soil scientist will evaluate the site with a salinity meter  
or
2. Soil samples will be taken and tested for salinity at the Oklahoma State University soils lab or any other soils lab using the same testing procedures and approved through the North American Proficiency Testing Program.

Soil samples will be collected in accordance with OSU Fact Sheet 2207 – How to Get a Good Soil Sample. Suspected areas should be sampled separately from the rest of the field. A salinity management analysis will be done on the soil sample. This analysis includes results for Na, Ca, Mg, K, B, EC, TSS (total soluble salts), Sodium Adsorption Ratio (SAR), Exchangeable Sodium Percentage (ESP), and pH. It is best to sample during a dry period of the growing season and should be taken at least one week after the last rain. Samples should only be taken from the top 1 to 3 inches of soil (seeding depth).

#### **TREATMENT FOR SALINE AND ALKALI SOILS**

Whenever the source of the salt or sodium is external, such as irrigation water, eliminate the source as soon as possible.

Apply conservation practices as needed to control erosion on the site.

#### **Improve Internal Soil Drainage**

Salt concentrations in the soil profile must be reduced in the plant root zone. Internal drainage in the soil profile must be good enough so that water

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can easily pass through the soil to leach salts out of the root zone.

There are a number of ways internal drainage can be improved. Tile drains and open ditches are effective in lowering subsoil water that accumulates above compacted clay and bedrock zones. The water table should be lowered to a minimum of 6 ft. below the soil surface for clays and loams and 4 ft. for sandy loams or lighter textures.

Compacted soil layers near the soil surface can be broken up by using deep tillage implements. The soil has to be dry enough to have a shattering effect on the hardpan layer.

#### **Incorporate Organic Material**

Once internal drainage is assured, the water movement into the soil must be improved. Incorporating 15 to 20 tons/ac of organic material, such as hay mulch, into the top 4 to 6 inches create large pore space for water to enter the soil.

#### **Apply Gypsum to Alkali Soils**

Management for saline and alkali soils is the same to this point. Alkali soils will require additional treatment.

Sodium is attached to the soil particles very tightly and must be replaced before it can be leached through the soil. Gypsum is the most effective soil amendment for removing sodium from the soil. It is a slightly soluble salt of calcium and sulfate. Gypsum will react with the sodium in the soil very slowly but for a long period of time.

The amount of gypsum required varies depending on the percent of exchangeable sodium and soil texture.

**See Table 1.**

**Table 1**

Soil Texture	Exchangeable Sodium Percentage				
	15	20	30	40	50
Tons per acre Gypsum					
Coarse	2	3	5	7	9
Medium	3	5	8	11	14
Fine	4	6	10	14	18

Incorporate the gypsum to a depth of only 1 or 2 inches in the soil. It should be mixed well enough with the soil to keep it from blowing away.

When the application of gypsum exceeds 5 tons/ac, the rate should be split into two or more applications of no more than 5 tons per application. Successive

applications should not be made until some time has allowed for leaching to occur (1 year) and a second soil test verifies the need for the additional application of gypsum.

#### **Management of Saline and Alkali Soils**

Inversion type tillage, such as moldboard plowing, should be avoided for several years to promote uninterrupted leaching of the salts through the soil profile. Inversion tillage brings soil and salts from the depth of tillage up to the soil surface and starts the leaching process over again. Avoid tillage when the risk for compacting the soil is high on problem areas.

When the salt level in the soil will permit, a salt tolerant crop or forage should be established on the problem area. It is especially important to have a crop or cover on the soil surface during the summer when evaporation is high. The surface should be kept covered as much as possible to keep moisture from evaporating and groundwater from wicking to the surface bringing up salts.

Use soil testing to avoid applying excess fertilizer. Fertilizers contain salts and if applied in excess can add to the problem.

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